

**Proposed Agreement between California Energy Commission
and
AWS Truepower, LLC**

Title: Application of a Solar Forecasting System to Utility Sized PV Plants on a Spectrum of Timescales
Amount: \$442,136.00
Term: 36 months
Contact: Michael Sokol
Committee Meeting: 3/16/2011

Funding

FY	Program	Area	Initiative	Budget	This Project	Remaining Balance	
09	Electric	Renewables	Utility-Scale Renewables	\$4,800,000	\$442,136	\$0	0%

Recommendation

Approve this agreement with AWS Truepower for \$442,136.00. Staff recommends placing this item on the discussion agenda of the Commission Business Meeting.

Issue

Governor Brown recently signed Senate Bill 2x, increasing California's Renewable Portfolio Standard (RPS) to 33 percent by 2020. The Governor's energy plan builds even further on these goals, adding 20,000 new megawatts (MW) of renewable energy to the grid by 2020 - 12,000 MW of localized electricity generation, and 8,000 MW of large scale renewables - and increasing combined heat and power production by 6,500 megawatts. Localized energy is onsite or small energy systems located close to where energy is consumed that can be constructed quickly (without new transmission lines) and typically with relatively low environmental impact. Combined heat and power projects (also known as cogeneration) use the excess heat or electricity generated by power plants or industrial facilities and are much more efficient than traditional power plants and many industrial plants.

Solar development and particularly utility scale solar development is a crucial part of achieving these various goals in Governor Brown's energy plan. The California Public Utilities Commission (CPUC) suggests that the technology mix, for the baseline scenario to reach 33 percent by 2020, will primarily rely on wind, solar thermal, geothermal, solar photovoltaics (PV) (at generation of 44 percent, 24 percent, 15 percent, 9 percent respectively) and the rest from low levels of biomass, biogas and small hydro (generation of 4 percent, 3 percent and <1 percent respectively).

As such, the need for reliable solar resource forecasts is becoming more important each year as increasing amounts of solar-generated electricity is incorporated into the electric grid. To facilitate integration of solar resources into an electric grid, forecasting capabilities for various time intervals need to be configured. These include: short-term forecasting for less than one hour to 3 hours ahead for frequency regulation and load following; day-ahead forecasts for supporting unit commitment decisions; and long-term forecasts for system planning and economic analysis purposes. A particular challenge to steady power production from solar energy plants is steep power ramps caused by shadows of relatively fast moving, low-level cumulus or stratocumulus clouds. Researchers have developed techniques for

forecasting these shadowing effects over specific time horizons, with no one method showing best performance over the entire minutes-ahead to days-ahead interval. A complete forecasting tool will need to incorporate multiple tools if it is to provide the best possible forecast on the operational time scale.

Background

On November 2, 2010 the California Energy Commission (Energy Commission) PIER Renewable Program released a Request for Proposals (RFP) for research needs of utility-scale renewable energy. The RFP announced that up to \$7.3 million was available from the PIER Program to fund initiatives that will help meet Research, Development and Demonstration (RD&D) needs related to more rapid and environmentally responsible deployment of Utility-Scale Renewable Energy (USRE) to the California electricity grid. The goal of the RFP was to support increased market penetration of multiple renewable energy technologies; reduction of impacts on land use, water consumption, and ecosystem resources; and mitigation of technical and economic barriers to the increased injection of non-baseload renewable energy sources into the transmission system.

Outreach to expand awareness of the RFP included pre-proposal workshops on November 9, 2010 held in the Energy Commission's Hearing Room A, in Sacramento, California and on November 16, 2010 held in the George T. Booker Conference Room in the University of California San Diego. The workshop covered in detail the application process, and provided a forum for questions and answers. The workshops, RFP, and questions and answers were advertised and published on the Energy Commission website.

On the proposal due date of December 21, 2010, the Energy Commission received 28 proposals. In accordance with the 2010 RFP Package, each proposal was screened for completeness, and reviewed by Energy Commission staff. Nine proposals were rejected from the administrative screening process. The Technical Advisory Committee reviewed, evaluated, and scored the proposals using the criteria prescribed in the Application Package.

Proposed Work

The proposed research will configure and demonstrate a set of solar forecasting tools for California that provides the best possible forecast of solar power production on time scales ranging from a few minutes to several days ahead. Three distinct forecasting approaches will be deployed. Sky imagery cloud motion vector analysis will provide high-resolution minute-to-minute forecasts based on detailed spatial and temporal knowledge of local cloud cover collected using sky imagers. Mid-range forecasts will employ satellite imagery in a similar vector analysis to predict production in the 1- to 6-hour ahead timeframe. Numerical weather prediction models employing a rapid update cycle and unique cloud initialization scheme will complete the forecasting portfolio for periods out to at least 2-days ahead. The forecasting system will be configured to Sempra's Copper Mountain photovoltaic facility near Henderson, Nevada, and operated for a period of one year to establish performance and validation metrics.

Justification and Goals

This project "[will develop, and help bring to market] advanced electricity technologies that reduce or eliminate consumption of water or other finite resources, increase use of renewable energy resources, or improve transmission or distribution of electricity generated from renewable energy resources" (Public Resources Code 25620.1.(b)(4)), (Chapter 512, Statutes of 2006)).

This will be accomplished by:

- Developing a best-possible forecasting tool for predicting solar plant output over the minutes-ahead to days-ahead forecasting horizon.
- Demonstrating and validating the solar forecasting tool at a utility-scale power plant providing 45 megawatts to the California electricity grid.